

Remarks

Claims 1, 4, 5, and 7-13 are pending in the application.

Claims 1, 4, 5, 8 and 10-13 are rejected under 35 U.S.C. §103(a) as being allegedly obvious over US 5,498,355 to Perozzi et al. ("Perozzi") in view of EP 0434464 A1 to Walters et al. ("EP '464") and US 5,242,613 to Ozbalik ("Ozbalik"). Claims 7 and 9 are rejected under 35 U.S.C. §103(a) as being allegedly obvious over Perozzi in view of Walters and Ozbalik, and further in view of US 6,133,207 to Milner et al. ("Milner"). Claim 8 is rejected under 35 U.S.C. §103(a) as being allegedly obvious over Perozzi in view of Walters and Ozbalik and further in view of European Patent Publication No. EP 0744456 A2 to Walters et al. ("EP '456"). Claim 5 is rejected under 35 U.S.C. §103(a) as being allegedly obvious over Perozzi in view of Walters and Ozbalik and further in view of US 4,282,153 to Minn ("Minn"). All rejections are respectfully traversed in light of the remarks presented herein.

Perozzi in view of EP '464 and Ozbalik

Claims 1, 4, 5, 8, and 10-13 are rejected under 35 U.S.C. §103(a) as being allegedly obvious over US 5,498,355 to Perozzi et al. ("Perozzi") in view of EP '464 and Ozbalik.

In the Office Action, independent claims 1 and 5 are rejected as allegedly obvious over Perozzi in view of EP '464 and Ozbalik. Claims 1 and 5 define gear oil compositions including, among other things, a di-t-butyl polysulfide mixture of di-t-butyl disulfide, di-t-butyl trisulfide, and di-t-butyl tetrasulfide, having a sulfur activity of greater than about 125mg in the Copper Corrosion Test. The gear oil compositions also include a dihydrocarbyl dithiophosphate ester, which claim 5 defines as the product of a mixture of dicyclopentadiene and dialkyldithiophosphoric acid. Further, the gear oil compositions also include a dihydrocarbyl (mono)thiophosphate amine salt.

The particularly claimed composition advantageously provides a dual purpose gear oil for both manual transmissions and final gear sets (page 2, lines 14-17). The composition also exhibits good thermal stability and clean gear performance, as well as being low in odor, and resulting in low wear in a high temperature axle and bearing test while also reducing the concentration of extreme pressure ("EP") alkyl polysulfide additives required without sacrificing the performance capabilities of the gear oil (page 3, Summary points 1-5).

Perozzi is directed to an engine oil dispersant composition of two different succinic derivative dispersants combined in a particular weight ratio to provide high dispersancy performance, especially when used in combination with metal-containing detergents. Generally, Perozzi makes reference to the fact that broad classes of extreme pressure ("EP") and anti-wear ("AW") agents may be used, only if desired, in conjunction with the mandatory dispersant composition. Included in the broad "laundry list"

disclosure of such EP and AW agents are dihydrocarbyl polysulfides and amine salts of phosphoric acid esters and their partial or total analogues (Column 16, Line 18 – Column 17, Line 24), which as one of skill in the art would know encompasses an uncountable number of possible compounds, far from a finite and limited number of predictable options. Even though many possible alternative agents are listed, no teaching or suggestion is given as to the selection of any particular compounds for any reason, or to use the claimed mixture of components in the claimed proportions for achieving the objectives of the presently claimed invention. It is also notable that Perozzi makes no suggestion as to a particular mixture of agents that would be useful in achieving the objectives of the presently claimed invention.

Further, Perozzi makes no reference to the sulfur activity of the polysulfide component. Further, the present claims call for a mixture of di-*t*-butyl di-, tri-, and tetra-sulfides. The activity of such a mixture is dependent upon the relative proportions of the low and high activity components in the mixture. Perozzi is manifestly deficient in disclosing the claimed di-*t*-butyl polysulfide mixture, and fails even further in teaching that the mixture has a sulfur activity corresponding to the claimed Copper Corrosion Test ("CCT") value of greater than 125mg, which one of skill in the art would use as a guide for the mixing of the claimed components to achieve the desired results during the practice of the invention.

Polysulfides, nonetheless mixtures of di-*t*-butyl trisulfide, di-*t*-butyl tetrasulfide, and di-*t*-butyl pentasulfide, exist which do not have a sulfur activity of greater than 125 mg in the copper corrosion test. Thus, the skilled person, starting from Perozzi, must still choose a polysulfide mixture which has a sulfur activity of greater than 125 mg in the CCT from among different possible mixtures which fall both above and below this sulfur activity level in order to arrive at the presently claimed invention. See discussion under number 7 of the previously submitted Declaration.

Perozzi does not mention the sulfur activity of its polysulfides nor does Perozzi provide any guidance to the skilled person to indicate that the sulfur activity is an important parameter. Further, Perozzi does not provide any incentive to select polysulfides having a sulfur activity of greater than 125 mg as measured by the CCT. Thus, from the teachings of Perozzi, taken alone, the skilled person would not have any reason to select polysulfides with a sulfur activity of greater than 125 mg as measured by the CCT in order to arrive at the subject matter of the present independent claims.

Moreover, the experimental data in the present application supports the conclusion that the specific subject matter of the independent claims solves the problem of providing a gear oil which passes all of the HT Axle Fatigue Test, the HT Bearing Test, and the L-42 Axle Shock Test. Examples C and E in Tables 1-2 on page 16 of the present application each represent a composition in accordance with the present invention and demonstrate that these compositions pass all three of these tests. See discussion under number 8 of the previously submitted Declaration.

Therefore, Perozzi fails to disclose or teach the combination as presently claimed and is absolutely silent as to the sulfur activity of a polysulfide component, which may or may not be included at all, and is likewise silent as to the inclusion of a dihydrocarbyl mono thiophosphate amine salt.

In an attempt to remedy the deficiencies of Perozzi to provide all of the elements and limitations of the present claims, EP '464 is combined with Perozzi. EP '464 is directed to a lubricant composition including an antiwear or load-carrying additive containing sulfur and/or phosphorus, and a corrosion inhibitor in the form of an amino succinated ester. The composition of EP '464 is said to be suitable for use in hydraulic fluids (page 2, lines 12-16).

There is a lack of motivation to combine Perozzi with EP '464. One of skill in the art reading Perozzi would learn about a dispersant system suitable for use in an engine oil. There is no motivation upon reading Perozzi to seek additional additives, much less seek additives suitable for use in a hydraulic fluid as taught in EP '464. Even if one were to read Perozzi in combination with EP '464, purely for the sake of argument, there is nothing in Perozzi that would lend one to select a dihydrocarbyl thiophosphate amine salt from EP '464 and combine it with the dispersant system of Perozzi absent impermissible hindsight after reading the present patent application. Perozzi discloses that antiwear and/or extreme pressure additives are optional components. Further, Perozzi does not lead or suggest that one should seek even further alternatives to those disclosed. Even further, there is no pointer or motivation to add components to those already disclosed in Perozzi. There is simply no motivation given in Perozzi to seek additional or alternative compounds to this already optional component.

That said, even if one were to make such a combination, EP '464 does not remedy the deficiencies of Perozzi in making the presently claimed invention obvious. Firstly, neither reference specifies the required sulfur activity for an included polysulfide mixture. Secondly, neither reference specifies the particularly claimed polysulfide mixtures. Further, there is a lack of motivation to combine the two references. The Office Action is picking and choosing components that are listed in the cited references as alternative, optional embodiments in order to make the presently claimed combination. Accordingly, the present claims are not obvious over Perozzi in view of EP '464.

In an attempt to remedy the deficiencies of Perozzi and EP '464 to provide all of the elements and limitations of the present claims, Ozbalik is cited. Ozbalik is directed to additives for oleaginous fluids containing extreme pressure and antiwear agents and containing less than 15 wt% higher dialkyl polysulfides. The polysulfide mixture is said to include more than 30 GC area % di-t-butyl trisulfide, from 5 to 10 GC area % di-t-butyl disulfide, from 2 to 40 GC area % hydrocarbyl thiophosphate or thiophosphine, and less than 15 GC area % higher polysulfides. There is no disclosure or mention in Ozbalik regarding sulfur activity or the CCT value of its polysulfide mixtures. Further, the relevance of targeting a particular sulfur activity value is not contemplated. Ozbalik does not mention or regard sulfur activity as an important parameter. Thus, from the teachings of Ozbalik, taken alone, the skilled person would not have any reason to select polysulfides with a sulfur activity of greater than 125 mg as measured by the CCT in order to arrive at the subject matter of the present claims. See the discussion under point number 7 in the previously submitted Declaration.

Mixtures of dihydrocarbyl trisulfide, dihydrocarbyl disulfide, and dihydrocarbyl tetrasulfide or higher polysulfides exist which do not have a sulfur activity of greater than 125 mg in the CCT. Thus, a skilled person starting from Ozbalik must still choose a polysulfide mixture which has a sulfur activity of greater than 125 mg in the CCT from among different possible mixtures which fall both above and below this sulfur activity level in order to arrive at the presently claimed invention. The CCT cannot be understood from Ozbalik. As discussed in point number 7 of the previously submitted Declaration, one of skill in the art practicing within the skilled ranges may have a fluid with a CCT value outside the presently claimed range of greater than 125 mg. If one were to use, for example, the CCT values given in Table 3 of the present specification and if one were to assume that the dihydrocarbyl tetrasulfide or higher polysulfides of Ozbalik were the same as those disclosed in Table 3, for example, then one would make a polysulfide fluid outside the scope of the present claims. See the Expanded Table 3 below (which is analogous to the Expanded Table 3 provided in the previously submitted Declaration regarding the previously cited, but now removed, Sullivan reference).

Expanded Table 3 from page 17 of Specification						
Ex. #	EP Additive	Sulfur	CCT (mg)	Ozbalik Ex. 11	CCT (mg) Contribution Using #5 Polysulfide	CCT (mg) Contribution Using #6 Polysulfide
1	SIB	Sx	55			
2	Polysulfide	Sx	126			
3	Di-t-butyl-disulfide	S2	2	29.3	0.293 * 2 mg = 0.586 mg	
4	Di-t-butyl-trisulfide	S3	4	49.8	0.498 * 4 mg = 1.992 mg	
				CCT subtotal	2.578 mg	
				CCT still needed to meet 125 minimum =	About 122.422 mg	
		S4+				
5	Di-t-butyl-tetrasulfide or higher (so the CCT value for di-t-butyl pentasulfide is used here)	S5	466	14.6	0.146 * 466 mg = 68.036 mg	
6	Di-t-nonyl-polysulfide	S4+	731	14.6		0.146 * 731 mg = 106.726 mg
				TOTAL Ozbalik CCT Range =	70.614	109.304

By using the contributions disclosed in Ozbalik and, for the sake of argument, relating to Table #3 in the present application, the relationship of CCT to specific polysulfides is seen. CCT can be stated as

the sum total of the contribution of specific sulfur linkages in the polysulfide mixture.

One can calculate the CCT contribution needed from the S4+ component in the Ozbalik mixture (i.e., the "dihydrocarbyl tetrasulfide or higher polysulfides"). Ex. #5 and Ex. #6 demonstrate two possible S4+ sulfur linkages proposed by the Ozbalik. One can calculate that 26.3% of dihydrocarbyl tetrasulfide or higher polysulfides (Ex. #5 example above) is required to boost the overall CCT of the polysulfide to the 125 CCT minimum that is presently claimed. (In other words, $122.422 \text{ CCT} / 466 = 26.3 \text{ wt\% Ex. \#5}$). The EP additive formulated from Ex. #6 above shows that 16.7% of this S4 or higher polysulfide is needed to meet the 125 CCT requirement presently claimed in our application. ($122.422 \text{ CCT} / 731 = 16.7 \text{ wt \% Ex. \#6}$). These amounts are outside the disclosed ranges in Ozbalik (i.e., less than 15 wt%).

Mixtures of polysulfides having sulfur activity greater than 125 mg in the CCT is a requirement of the present claims and is demonstrated in the present data. See Tables 1 and 2 of page 16 of the present application. The experimental data in the present application supports the conclusion that the specific subject matter of the independent claims solves the problem of providing a gear oil which passes all of the HT Axle Fatigue Test, the HT Bearing Test and the L-42 Axle Shock Test. Examples C and E in Tables 1-2 on page 16 of the present application each represent a composition in accordance-with the presently claimed invention and demonstrate that these compositions pass all three of these tests. Comparative Examples A-B in the present application demonstrate that compositions containing SIB as the sulfur-containing additive and having a sulfur activity of only 55 do not pass all three tests. Comparative Example D demonstrates that a composition containing all ingredients of the presently claimed invention, as well as an additional acid phosphate salt, but having a sulfur activity of 4, does not pass all three tests. Comparative Example F demonstrates that a composition containing all ingredients of the presently claimed invention, but having a sulfur activity of 4, also does not pass all three tests. Further, there could be thermal stability issues if it is too high and poor EP performance if it is too low. The present patent application relies on the fact that a significant portion of the EP additive is from the thermally stable dithiophosphate, thus keeping the concentration down for the polysulfide. But if the polysulfide is too low in CCT, there will not be enough for EP performance.

The presently claimed invention is thus considered to be nonobvious over the cited references since the cited references alone or in combination do not provide the skilled person with any indication of the importance of the sulfur activity of the composition. Nor do the cited references alone or in combination appreciate that use of a sulfur activity of 125 or greater would allow formulation of compositions which can pass all three of the HT axle fatigue test, HT bearing test, and L-42 axle shock test. The present comparative examples D and F clearly show that the sulfur activity is important to solving the problem of the presently claimed invention by isolating this parameter relative to Examples C and E of the presently claimed invention.

Therefore, the combination of Perozzi in view of EP '464 and Ozbalik is deficient in making the present independent claims obvious. The present independent claims, and likewise their dependent claims, are nonobvious over the cited combination.

Perozzi in view of EP '464 and Ozbalik and further in view of Milner

Claims 7 and 9 are rejected under 35 U.S.C. §103(a) as being allegedly obvious over Perozzi in view of EP '464 and Ozbalik, and further in view of US 6,133,207 to Milner.

For the reasons given herein, the present claims are nonobvious over Perozzi in view of EP '464 and Ozbalik. Milner is further cited in combination with these references. Milner discloses a presulfurization process that reduces odor in certain phosphorus-containing additive compositions. Milner is silent as to the present combination of a polysulfide mixture having a sulfur activity of greater than 125 mg in the copper corrosion test, a dihydrocarbyl dithiophosphate ester, and a dihydrocarbyl (mono)thiophosphate ester. Therefore, Milner does not make up for the deficiencies of Perozzi in view of EP '464 and Ozbalik in making the present independent claims obvious. The present independent claims, and likewise their dependent claims, are nonobvious over the cited combination.

Perozzi in view of EP '464 and Ozbalik and further in view of EP '456

Claim 8 is rejected under 35 U.S.C. §103(a) as being allegedly obvious over Perozzi in view of EP '464 and Ozbalik and further in view of EP '456.

For the reasons given herein, the present claims are nonobvious over Perozzi in view of EP '464 and Ozbalik. EP '456 is further cited in combination with these references. EP '456 is directed to a lubricant composition including an oil-soluble sulfur-containing antiwear and/or extreme pressure agent of low activity, described as 65mg or less on a copper corrosion test (page 4, lines 29-34). EP '456 especially prefers sulfurized olefins of low activity (page 4, lines 43-47). Accordingly, EP '456 does not teach, disclose, or suggest the presently claimed polysulfide having a CCT value of greater than 125mg. EP '456 is silent as to the present combination of a polysulfide mixture having a sulfur activity of greater than 125 mg in the copper corrosion test, a dihydrocarbyl dithiophosphate ester, and a dihydrocarbyl (mono)thiophosphate ester. As discussed herein, a polysulfide having the claimed sulfur activity is essential to the presently claimed invention. See the discussion on experimental data above and particularly the comparative data showing that a sulfur activity below 125 mg provides failing test results.

In the Office Action, the Examiner states that the sulfur activity required in EP '456 is irrelevant for the purposes of making the present claims obvious. The Applicants respectfully disagree. If one were to make a combination including the total of these 4 cited references, which they in fact would have no motivation to do, and each reference except EP '456 is silent as to sulfur activity, one of skill in the art might consider the teachings of EP '456 to this point since it is the sole reference that even mentions this

parameter. Lastly, the fact that EP '456 discloses a thiophosphate amine salt does nothing to remedy the deficiencies in the previously made combination of Perozzi, EP '464, and Ozbalik, especially since the thiophosphate amine salt is taught to be a required component with a sulfur-containing component having a low sulfur activity. The total combination of these 4 references still does not make the present claims obvious.

EP '456 does not make up for the deficiencies of Perozzi in view of EP '464 and Ozbalik in making the present independent claims obvious. The present independent claims, and likewise their dependent claims, are nonobvious over the cited combination.

Perozzi in view of EP '464 and Ozbalik and further in view of Minn

Claim 5 is rejected under 35 U.S.C. §103(a) as being allegedly obvious over Perozzi in view of EP '464 and Ozbalik and further in view of Minn.

For the reasons given herein, the present claims are nonobvious over Perozzi in view of EP '464 and Ozbalik. Minn is further cited in combination with these references. The total combination of these 4 cited references still does not make the present claims obvious. Minn is directed to an insecticidal composition. Minn fails to make any teaching, disclosure, or suggestion as to the claimed components in the claimed proportions. Just as with the other three references discussed above, Minn is also manifestly deficient in teaching, disclosing, or suggesting the claimed polysulfide having the claimed CCT value of above 125mg. Further, there is a lack of motivation apparent from any of the 4 cited references to make the presently claimed combination.

Minn does not make up for the deficiencies of Perozzi in view of EP '464 and Ozbalik in making the present independent claims obvious. The present independent claims, and likewise their dependent claims, are nonobvious over the cited combination.


Reconsideration and allowance of claims 1, 4, 5, and 7-13 is hereby respectfully requested.

Conclusion

Applicants respectfully submit that a full and complete response to the office action is provided herein, and that the application is now fully in condition for allowance. Action in accordance therewith is respectfully requested.

It is the belief of the undersigned that there are no fees associated with this filing. However, in the event that the calculations are incorrect, the Commissioner is authorized to charge any deficiencies in fees or credit any overpayment associated with this communication to Deposit Account No. 12-2355.

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